SEVENTY-FIRST YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIII.]
NUMBER 24

NEW YORK, DECEMBER 11, 1915

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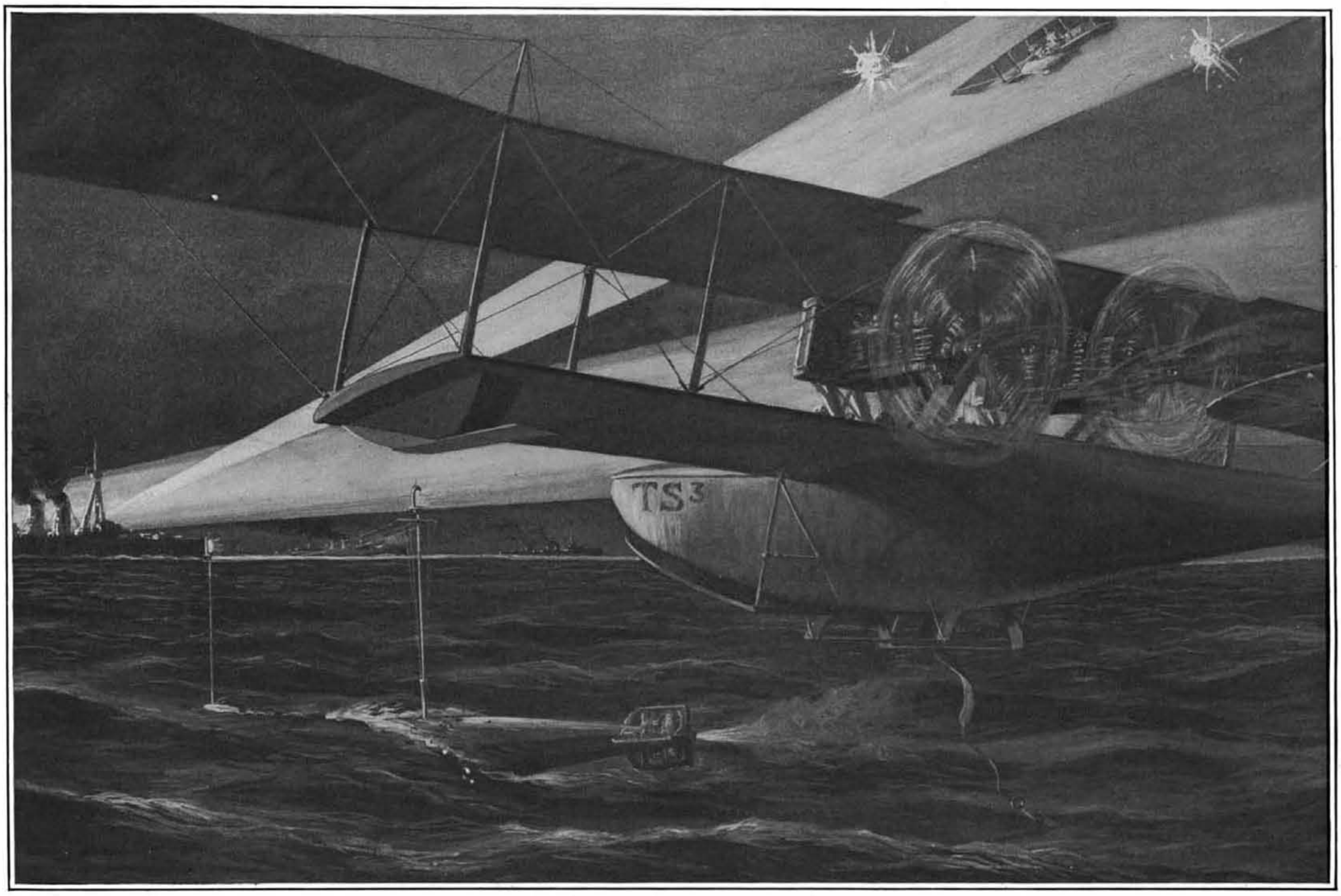
A New Form of the Fighting Aircraft

By Robert G. Skerrett

DESPITE all that has been said to the contrary, the United States Navy, technically at least, is making material strides in the field of aviation. A short while since a seaplane was launched into the air by means of a catapult from the deck of the U. S. S. "North Carolina" while that cruiser was under way. This achievement blazes the way for the practical coöperation of aircraft and fighting ship when hundreds of miles or more at sea. It reasonably bids fair to modify radically the strategic problems of battle squadrons, especially so far as getting in touch with the enemy is concerned, and then planning the best way to force an action or to avoid one, as the exigencies of the moment require.

To be sure, aeroplanes have been launched from the decks of some of our vessels before, and at the Dardanelles the British have found their aviation ship, the converted merchant freighter "Ark Royal," extremely useful. But the "Ark Royal," like our own earlier ships used for aviation experiments, has been uniformly anchored in comparatively sheltered waters when the flying machines took their flights from her deck. Besides this, the machines have been small ones and of extremely limited endurance. Nevertheless, the air pilots, working from that base, have been able to serve the fleets well by marking the fall of shell hurled by indirect fire upon hidden enemy batteries. But this service is not identical with that of coöperating with a squadron at sea bent upon discovering the foe or intent upon covering the transportation of a large body of troops. What has lately been done in adapting Capt. Washington I. Chambers' catapult for use aboard a moving ship brings us measurably close to the wider use of seaplanes in concert with battle craft anywhere.



Launching a radio-controlled torpedo from a hydro aeroplane. Lights carried by the torpedo, but invisible to the enemy, permit of tracing and controlling the course of the projectile

What was done aboard the U. S. S. "North Carolina" clears the way for still another radical application of big seaplanes. About three years ago Rear-Admiral Bradley A. Fiske, U. S. N., obtained a patent covering a method and an apparatus for delivering submarine torpedoes from airships. Briefly, his idea was to carry, slung below the flying machine, a moderately light, short-range automobile torpedo. When near enough to the enemy to make reasonably sure of scoring a hit, the seaplane was to swoop down close to the water, drop the torpedo, and leave that weapon to cover at full speed the interval between it and the target. This really embraced an amplification of coast defense, and the aeroplane was expected to start from the shore on its mission.

By perfecting the catapult it will be feasible to launch the so-called "flying-fish torpedo" from a speeding ship. It is a fact that a big destroyer can be detected at night farther away than it is practicable to locate an approaching aircraft. The destroyer must launch its torpedoes on their journey miles away from the target. On the other hand, a seaplane capable of carrying an automobile torpedo will stand a much better chance of scoring a hit, especially when the enemy vessels are moving, because it can get nearer undiscovered. But Rear-Admiral Fiske has amplified this novel form of torpedo warfare.

Inasmuch as seaplanes are now available that can lift heavy loads, he purposes transporting through the air bigger torpedoes than originally contemplated, and in this way to deal a more destructive blow against the improved under-water defense of the most recent of dreadnoughts. As the torpedo would not have to travel as far as one fired from the ordinary fighting craft, weight could be saved in its general design, especially in the motive department, and this means an increased explosive charge in the war head. But in order to reduce to a minimum the chance of missing, the latest scheme advanced by Rear-Admiral Fiske embraces a dirigible torpedo—one susceptible of wireless control.

There has been a characteristic weakness in dirigible torpedoes heretofore proposed. They could not be kept track of from the operative base for any distance when the air was hazy or the light dim: their employment after nightfall was practically out of the question. John Gardner of England, one of the most successful experimenters in this field of telautomatics, abandoned his labors, although he had accomplished much that should have encouraged him to go on. His reasons for dropping the task have been thus explained: "There is now no great difficulty in governing the functions of a torpedo without tangible connections, and with reasonable freedom from interference; but the weapon, or some object carried by it, must remain visible to the operator throughout its run. Late years have seen a great increase in the range of ships' guns: it is possible that hostile ships will never get within four or five miles of each other. Obviously, a wireless torpedo, to be of use in such an action, must be visible to its controller at a distance of four or five miles. The simple fact is that no object that can be carried by such a small vessel as a torpedo can be seen at that range in anything but

(*Concluded on page* 527)

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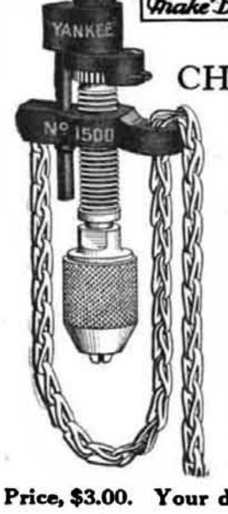

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Drainage wells, 15 feet apart longitudinally, formed of porous concrete blocks, extend from an inspection gallery below the top of the dam near the upstream face to an inspection gallery near the level of the reservoir bottom, which in turn connects with a transverse drainage gallery leading to the downstream face of the dam.

Dignity and beauty have been sought in the architectural treatment of the downstream face of the Kensico dam. Since the dam is divided for structural reasons by 22 expansion joints, its downstream face has 21 panels and two terminal structures. In its completed state the dam will be traversed by a public highway, which will approach from the east over a three-arch masonry bridge across a nearby waste channel of the reservoir.

In conclusion, a few of the more important figures in connection with the Kensico reservoir may be of interest, serving as they do toward an accurate conception of the magnitude of the undertaking. The total capacity of the reservoir is 38,000,000,000 gallons, with an available capacity of 29,000,000,000 gallons. The water surface will be 3.5 square miles, or 2,218 acres, while the land acquired for the reservoir totals 7 square miles, or 4,500 acres. The length of the reservoir is 4 miles, while the length of the shore line is 40 miles. The maximum width is 3 miles and the average width 1 mile. The elevation of the top of the dam above tide is 370 feet, with a maximum thickness at the base of 235 feet. The maximum thickness at the top is 28 feet. The maximum depth of the reservoir is 155 feet, with an average depth of 52 feet. In the construction of the reservoir 1,480,000 cubic yards of earth and rock were excavated. The embankment required 2,110,000 cubic yards. In the building of the reservoir 1,016,000 cubic yards of masonry was laid and 997,000 barrels of cement was used.

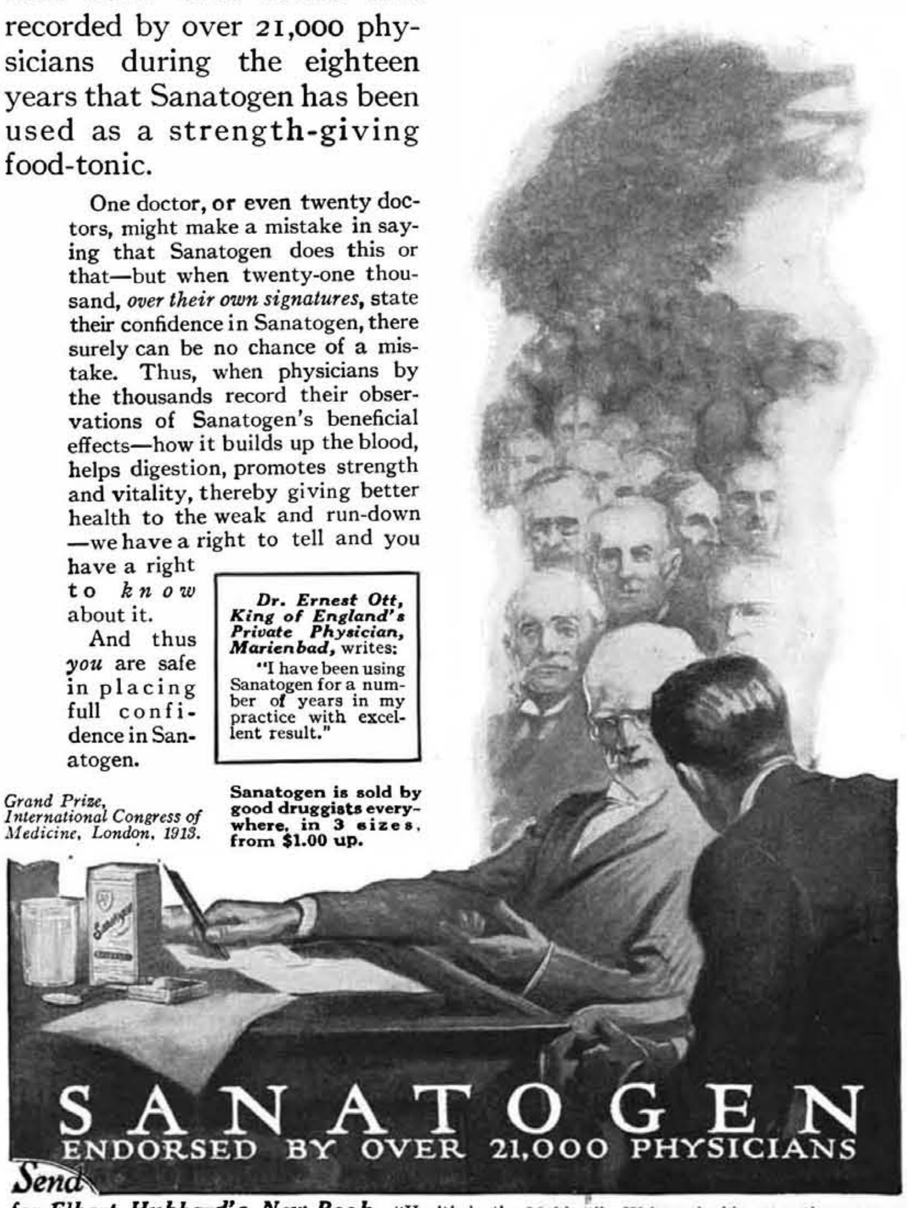
A New Form of the Fighting Aircraft

(*Concluded from page* 513)

an absolutely flat sea and clear weather. As the range of guns is likely to increase rather than diminish, I came to the conclusion that wireless torpedoes were 'out of it' for the reason I have described."

But Rear-Admiral Fiske has surmounted this difficulty. As he explains it, "In order to extend the usefulness of my invention to localities far from shore, my plan is to combine wireless control with my original scheme, in which a torpedo is dropped from an aeroplane. I would put the torpedo under one of the present giant aeroplanes and the latter to have a ship for its operative base. The seaplane would then fly with its weapon toward the enemy battleship or squadron, and when, let us say, four or five miles away from its objective, drop the torpedo into the water. The torpedo can then be guided by wireless, and the wireless control could be exercised either by a ship in the distance or else from another accompanying aircraft large enough to carry the necessary wireless apparatus. The latter seaplane would, of course, follow up the torpedo and keep it in sight well nigh until it had actually hit its target. In case, however, that the control wireless mechanism were aboard a ship, it would be necessary, of course, to inform the vessel how to steer the torpedo. For this purpose wireless on the aeroplane carrying the torpedo would answer.

"The dirigible torpedo should have bow and stern uprights for navigational guides and to support the wireless receiving outfit; but I do not think this arrangement would prevent the torpedo and its explosive charge from having a sufficient immersion. Of course, the uprights would cut down the speed somewhat, but dirigibility and the ability to work during the hours of darkness would more than offset this seeming handicap." The torpedo would be equipped with a



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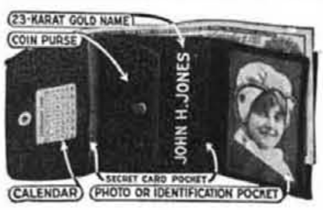

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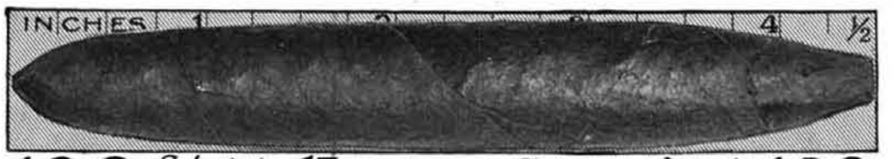

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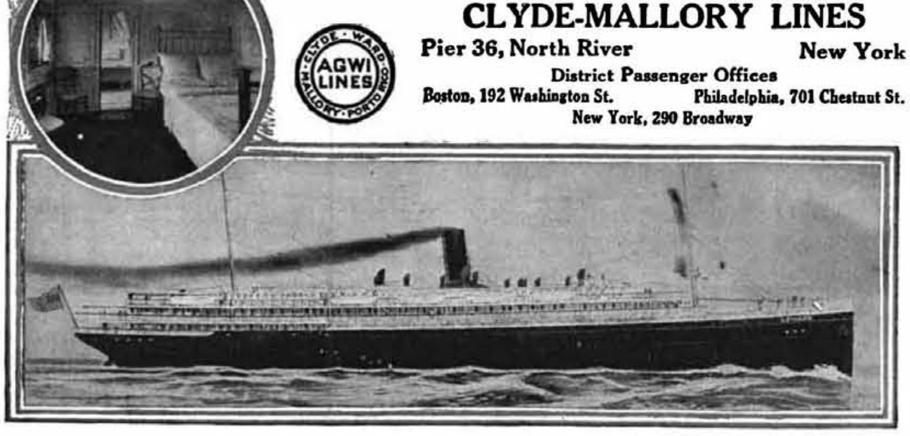

small light on each navigational upright, and these would be so screened that they could be seen only from the rear and upward from that position. The submarine is not an effective means of attack in the open sea at night, especially when the waters are troubled; nor, with up-to-date searchlights and with a battleship's screen of destroyers alert, can enemy destroyers hope to reach the capital ships by torpedo attack after nightfall. Rear-Admiral Fiske's employment of seaplanes for the carriage of dirigible torpedoes, thanks to what the catapult now promises, provides a way to surmount the protecting screen of destroyers and then to get inside of that line of defense and close enough to deliver a successful torpedo attack.

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A TEXT-BOOK OF BACTERIOLOGY. A Practical Treatise for Students and Practitioners of Medicine. By Philip Hanson Hiss, Jr., M.D., and Hans Zinsser, M.D. New York: D. Appleton and Company, 1915. 8vo.; 766 pp.; 155 illustrations.

Those who have used this work in its first edition will find that its revision embodies the more important researches of the past three years; extensive changes and additions are found under such subjects as streptococci, plague, leprosy, syphilis, rabies, and poliomyelitis. New material appears under typhus fever and rat-leprosy. The new edition also takes account of Churchman's recent work on anilin dyes and bacterial growth, and of the Anderson and McClintic method of standardizing disinfectants. The beginner will find in the text the laws and technique of bacteriology as illustrated by their application to the study of pathogenic bacteria. In the section on immunity he is introduced in a simple, informal way to the more difficult problems of the field, and is given a basis for further reading. The text is peculiarly adapted to the medical student, and the full-fledged practitioner may also find it of value as a reference book and for review reading.

ELECTRICAL WIRING SPECIFICATIONS. By J. H. Montgomery, E.E. New York: D. Van Nostrand Company, 1915. 16mo.; 139 pp. Price, $1 net.

This little manual offers a helping hand to the architect or contractor faced by the necessity of drawing up specifications for electrical work. No attempt is made to include equipments of large size and special apparatus. Close attention to the instructions should enable a contractor to draw up a specification that states clearly and completely the exact work to be done; that indicates exactly the grade of workmanship; that defines the duties of the contractor, and that names approved materials so specifically that there is no chance for dispute. There are some practical rules for illumination that will give good results under ordinary circumstances, and some common sense instructions relating to inspection and superintendence.

PLANE GEOMETRY. By Claude Irwin Palmer, A.B., and Daniel Pomeroy Taylor, A.M. Edited by George William Myers, Ph.D. New York: Scott, Foresman and Company, 1915. 8vo.; 277 pp.; illustrated. Price, $1.

"Plane Geometry" aims at a real motivation of geometry on the part of the student; in other words, the authors bring to their task a sharp realization of the fact that the student should appreciate his task at its full value, and should gain a perfect insight as to its meaning. Geometry as a system of thought only attains its full usefulness when its spirit is appreciated. Thoroughly understood, it inculcates habits of reasoning and discrimination that may be applied to wider spheres; the scientific gain is obvious. Hence "Plane Geometry" stresses the usefulness of the study, and follows abstract exercises with concrete problems necessitating the application of the theoretical principles. The authors are high-school teachers of long experience, and their text is the residuum of manuscript layouts perfected through years of classroom work.

THE PRINCIPLES OF FLORICULTURE. By Edward A. White. New York: The Macmillan Company, 1915. 12mo.; 467 pp.; illustrated. Price, $1.75.

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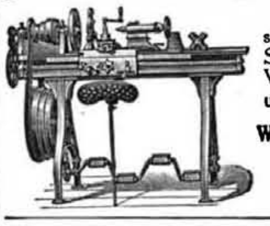

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Unmuzzling Our Naval and Military Officers

THE persistent refusal of the Administration to make public the plans of the War College and the General Staff of the Army for the reorganization and enlargement of our military forces is the latest evidence that the civilian head of the Army is determined to follow out the Administration's policy of sealing the lips of our naval and military men and interposing a barrier between the people of the United States (who are literally thirsting for information, not merely on this but upon every subject pertaining to our national unpreparedness) and the only men who are qualified by experience and knowledge to give them that information.

The history of naval and military affairs in this country proves that, with few exceptions, the civilian heads of departments have betrayed an exaggerated sensitiveness regarding the prerogatives of their position as the mouthpiece of the departments over which they presided. This unfortunate and unjust attitude reached its climax at the opening of the present war, when an explicit embargo of silence was laid upon every ranking officer and placed upon his desk in printed form. No discretion whatsoever was allowed them; their lips were securely padlocked, and it was well understood that the slightest infringement of this order would be met with condign punishment.

Now this was done at the very time, above all others, when the people of the United States were most eager for information about the instruments of warfare, its practice, the strength and quality of the forces engaged, and the thousand-and-one subjects of fascinating interest which would be involved in the great World Struggle. It is well understood that there is much information of a secret and confidential character, relating both to our own naval and military establishments and those of the Powers at war, which, in the nature of things, can never be made known; but outside of this there is a vast amount of information of the kind which the public desires to have, and which our naval and military men would be only too willing to give, which is denied to the public because of this foolish and quite unnecessary embargo.

This raises the question as to whether the time has not arrived for the Administration to assume a more generous attitude to our naval and military officers, and treat them with the confidence and dignity which are due to men of their high professional attainments, strong loyalty and unquestioned patriotism. And, above all, it is high time that both Congress and the Administration should get rid, once and for all, of that time-honored and foolish old bugaboo of what it is pleased to call "militarism," which, as it affects the Army and Navy, takes the form of a belief, or suspicion, or whatever it should be called, that your military man is at heart a fire-eating swashbuckler, who is consumed with a burning desire to turn the United States into an armed camp and rush the country into war upon the slightest pretext.

Now, this attitude is largely traditional. It is an over-late survival of the distrust of military force as expressed by a large standing army, which manifested itself in the young Republic at the close of the War of the Revolution. It was reasonable and was to be expected in those times; but so far as the United States is concerned, it is utterly unreasonable to-day; for there is absolutely nothing in the record of the Army and Navy during the past one hundred and thirty years to indicate that either branch of the service has at any time desired to arrogate to itself an undue authority or concern itself with other than purely naval and military affairs.

In fact, the boot is altogether on the other leg. Politics has interfered at times outrageously with the Army, as Mr. Oswald G. Villard has shown so ably in a recent series of articles; but the Army and Navy, as a whole, have never concerned themselves with politics. And as to that other suspicion—that our naval and military men desire to impose upon the country an Army and Navy altogether beyond its requirements, and that it is their wish to cultivate an aggressive military spirit, all we have to say is that, after twenty years of intimate intercourse with officers of all ranks in the two services, we have failed to note the slightest trace of any such spirit. And as to the charge that our officers are at all times eager for war, because it would offer them exceptional opportunities for advancement, we do not hesitate—and we know whereof we speak—to denounce the charge as a most unwarrantable aspersion upon the professional integrity and the pure patriotism of the finest body of professional men in the country.

There is, to-day, a widespread demand throughout the country that the public shall be put in closer touch with its naval and military experts; that their lips shall be unsealed, and that the people shall have, at first-hand, the benefit of the advice and direction of the only men who are qualified to tell them just what kind of an Army and Navy they need, adequately to protect their vast and ever-increasing national interests. Our experts would like to speak to the country, and the country certainly wants to listen. It has grown very weary of having the recommendations of these experts pigeonholed, and of being presented, instead, with the half-baked and necessarily immature and more or less amateurish recommendations of some well-meaning gentleman who, only yesterday, and all his life, may have been either, let us say, a lawyer, a country editor, a professor or anything indeed but a student of naval and military affairs.

The Aeroplane Dreadnought

THERE remains one redeeming feature in the tragedy of the European war—the rapid development it has forced upon aviation. Although the paramount civilian demand of "safety first" had to take second place to speed, progress in the directions of capacity for high and fast climbing, great loads in fuel, bombs and armament (unless accomplished at the expense of solid construction), necessarily leads to safety as well. This is obvious concerning the fundamental military demand for a motor proof against failing above the enemy's lines; but extreme speed and rapid climbing call for many times the power needed for mere support, and in the many authentic reports of war aviators one feature stands out prominently—the wonderful control motors of one hundred horse-power and more, with their large propellers, give to a pilot under critical conditions. Evidently this military flying closely approaches the degree of safety demanded for the aerial automobile of the future. It is plain that a war flyer of to-day, in stormy winds, heeds the possibility of a fall about as much as a horseback rider in jumping hurdles. In dodging the enemy's fire, in the wildest tumble of aerial fighting, when no thought is left for any intricacies of flying, the machine responds like a thoroughbred. Pilots, while half unconscious and pain-crazed from mortal wounds, have covered forty miles. The contingency always dreaded is when a hit motor gives out before the machine has been put to a sharp glide.

Development in times of peace would demand only that this amount of control be attained by something cheaper than extravagant motors, and that any aeroplane, to be safe, need not come up to the fighter's "automobile racer" standard. Incidentally, it demands that an "aerial chauffeur" should be able to serve more than one or two passengers. The recent demand for great loads of armament—for aeroplane dreadnoughts—meets this demand perfectly. Very fortunately, the Curtiss experiments for a Transatlantic aeroplane and the Sikorsky "omnibus" had long paved the way for its present successful answering. The new German "battle-plane," with two fuselages, belongs to the same class; but there is an inherent feature in the "dreadnought" which is bound to advance the general navigation of the air, because it concerns safety—and "safety first" should be ceaselessly repeated to the sponsors of the commercial aeroplane. The "steady flight" of Sikorsky's craft gave such a favorable impression that, but for one reason—their dependence on never-failing motors—we should have seen many imitations before such motors yet became imperative. A Sikorsky with motor trouble is far worse off than a disabled Zeppelin. Few are the spots large and level enough to come down without breakage; and even more rare are those from which to restart. Motor trouble thus means in most cases tearing down the huge fabric and carting away the debris. Curtiss' big waterflyers are exempt from such dangers so long as they are above their element, and motor perfection will eventually establish the Sikorsky. Superposing more than two planes will also make "dreadnoughts" less cumbersome, more solid for the same weight, and less dependent on very large landing grounds. Another advantage is their wonderful inherent stability.

This could be more exactly described if aerodynamic laboratories, which have so minutely ascertained the action of steady air streams on small models, had attempted to shed some light on the mechanism of "gusts"—an all-important question for safety. It could hardly be very difficult to reproduce any variety of "gusts" in wind-tunnels by screens or blasts, ascertain their exact nature by photography, and accurately measure their effect on the center of pressure. Some of the results would certainly happen to coincide with natural disturbances.

Another obvious question, neglected by scientists, is beyond the wind-tunnel's scope, but is easy to investigate by attaching pressure gauges to the wings of full-sized machines. We refer to the influence of size on wing pressure. Both these problems enter prominently into the theory of the "dreadnought."

Undoubtedly the pressure per unit of surface for the same speed should increase with the size, because size obviously augments the thickness of the supporting air stratum—as plainly shown by the old rule that superposed wings should be spaced apart the length of the chord. Another practical proof is the fact that pictures show Curtiss' "America" is essentially a linear increase of a flying boat, which necessarily implies that, barring unpermissible decrease of solidity, weight has grown faster than surface. The Sikorsky looks, also, like an exaggerated albatross. Nevertheless, both these "dreadnoughts" are excellent lifters. Enlarging an aeroplane—other things being equal—makes the leverage offered to gusts grow with the linear dimensions, the surface with their square, and weight and inertia with their cube. The showing of the Sikorsky and the big Curtiss (as well as the stability of the comparatively big, standard, military 100-horse-power plane) makes it very probable that the still-unknown mechanism of gusts works in such a way as to make the small increase of leverage outweigh the squaring of the surface and the sort of cubing of the total pressure on the wing. Evidently a gust on a larger wing has its effect less increased by the greater width of wing offered, and still less by the greater thickness of the acting air stratum, than it is alleviated by the merely linear increase of leverage; while the resisting force, the inertia of the whole machine, grows with the cube of the dimensions. There is no doubt about the last-mentioned fact, because mere linear increase of dimensions and cubic increase of weight make a dreadnought not even as strong as a smaller machine (owing to relative decrease of strength of materials). Hence, for the mammoth dirigible a new design is imperative.

The Beneficent Toad

THE toad has always been looked upon as loathsome, even poisonous. Yet modern medical research is extracting from toadskins remedies of the greatest value and the beneficent possibilities of these secretions have by no means been exhausted.

Quack remedies have long been made from the skins of toads and the Chinese still use such an extract, called "senso," as a cure for dropsy. A well-known remedy among the New England colonists for sprains and rheumatism was a toad ointment made as follows:

Four good-sized live toads; put into boiling water and cook very soft; then take them out and boil the water down to one half pint, and add fresh churned unsalted butter, one pound, and simmer together; at the last add tincture of arnica two ounces.

In the light of Dr. Abel's brilliant work these old remedies take on a new meaning. Abel studied the giant tropical toad, Bufo agua, found in the Upper Amazon. The natives of that section of Brazil make an arrow poison from the creamy secretion of the skin glands, a poison so powerful that it kills big game in a few moments. From this secretion Abel isolated adrenalin, a blood-pressure-raising medicine invaluable to the specialist and the surgeon. Previously this substance had been extracted from the suprarenal glands of the ox or sheep and later had been synthesized in the laboratory from coal tar as it was found to be nothing more than di-hydroxymethyl-aminoethylol benzene.

But the most valuable and startling part of Dr. Abel's work with this toad secretion was the isolation of a beautiful crystalline substance to which toadskin owes its curative powers for dropsy. This he named "bufagin," and the most active investigation of its properties is now in progress. It seems strange that after a century's ridicule of a toad treatment for dropsy as a mere grandmother's remedy we should now find a genuinely scientific confirmation of the practice. It may be objected that all varieties of toads do not give the same secretion as the giant toad from the Amazon, but it has only recently been found that another crystalline substance, bufotalin, of very similar properties to the bufagin, is found in the skin of the common European toad.

Radio Communications

Radio Operators are Enlisting in Great Numbers in the ranks of the belligerent nations of Europe. It is reported that in the British navy alone there have been over 5,250 radio operators who have enlisted. Among those serving on warships one has earned the Victoria Cross, one the Cross of the Legion of Honor, and four the Distinguished Conduct medals.

New Installations of Navy Department.—There are being installed on the roof of the State, War and Navy Building at Washington five wireless receiving and short-distance transmitting sets, which, when completed, will enable the Navy Department to communicate with vessels while in no way interfering with the Arlington station. Thus the newly created office of naval operations, over which Rear Admiral Benson presides, will be in direct communication with the fleet and with the Arlington station.

Proposed Radio Service Between New York and Buenos Aires.— An American wireless company has obtained a concession from the Argentine Republic government for the erection of a high power radio station at Buenos Aires, to be used for constant communication between that country and the United States. It is planned to erect 1,000-foot towers at both stations in order that the intervening distance of 4,600 miles may be covered under all conditions. The transmitters will probably be of 300 kw. capacity.

New Record for Radio Transmission.—On November 29th a radio operator of the Federal Wireless Telegraph Company, stationed at Honolulu, succeeded in intercepting messages sent out by the high power station at Nauen, near Berlin, Germany. At the time the German station was sending war dispatches, and so perfect was the reception of the signals that the Honolulu operator "copied" the messages without difficulty. The distance traversed by the signals was approximately 9,000 miles, establishing a new world's record in radio transmission.

Value of Radio Communication in Saving Lives.—During the fiscal year 1915 the radio inspectors of the United States Bureau of Navigation reported 26 cases of vessels leaving American ports which met with accident or disaster, requiring the use of radio communication to summon assistance. Four of these were from fire; 12 were from running ashore, stranding, or getting into an ice jam; 3 were from breakage of machinery; 4 resulted from collisions; 1 from shifting of cargo; 1 vessel was storm battered and water logged; and I was torpedoed. Excepting in the case of the "Lusitania," which was torpedoed, the assistance thus rendered resulted in but two lives being lost.

Wireless Telegraphy and the United States Navy.—A message recently sent by Secretary of the Navy Daniels to all commanding officers of the Navy, casts light on the influence of radio communication on naval affairs. It forcibly indicates that because of the advent of wireless telegraphy, enabling officers and Washington authorities to be in constant touch with each other, the officers no longer are compelled to exercise as much initiative as they did in previous years. The message follows: "Due to the ease with which the Navy Department can be communicated with from all parts of the world, no commander-in-chief, divisional commander, or commanding officer, shall issue an ultimatum to the representative of any foreign government or demand the performance of any service from any such representative that must be executed within a limited time without first communicating with the Navy Department, except in cases where such action is necessary to save life."

Interesting Facts on Earth Resistance.—Speaking before Section G of the British Association, E. W. Marchant has disclosed several interesting facts in regard to his experiments with earth connections for radio stations. In connection with his experiments made at a wireless station at Liverpool, three different types of "ground" were employed, viz., the water pipe system of the building, an earth connection formed of fourteen 2-inch cast iron pipes, pointed and driven about one foot into the ground, and a copper plate 1 foot 6 inches wide and 4 feet 6 inches long, buried vertically at a depth at the lower edge of 6 feet below the surface and connected to two copper strips laid at a depth of 6 feet, each 1 inch wide and 40 feet long. In the two latter cases the pipes and copper plates were laid directly in the earth, without a surrounding volume of coke such as is usually recommended. By certain methods and calculations the resistance of the three "grounds" was found to be as follows: Copper plate and strip, 6.1 ohms; iron pipes, 42 ohms; water pipes, 3 ohms. By reversing the current used in the measuring of the resistance, the results were: Copper plate and strip, 7.1 ohms; iron pipes, 40 ohms; water pipes, 2.7 ohms. Thus it will be seen that the water pipe system of a building comprises the best obtainable "ground," while a sheet of copper buried in the earth is a poor second.

Astronomy

M. Georges van Biesbroeck, adjunct astronomer of the Royal Observatory of Belgium, has become temporarily a member of the staff of the Yerkes Observatory, with the title of visiting professor of practical astronomy. The staff of the Belgian observatory appears to be widely scattered, though some of its members are, or recently were, still at the observatory, which is now under German control.

Movement of the Martian Canals.—With regard to the alleged shifting of the canals of Mars over the face of the planet Prof. Lowell states in *Popular Astronomy* that this phenomenon was detected at his observatory nineteen years ago, and is therefore no novelty. He believes that there is not an actual displacement of the canals, but that there are, in each case, several canals that become successively visible.

The Melbourne Observatory, which was founded in 1863 and is one of the well-known astronomical institutions of the southern hemisphere, will probably soon be closed. The veteran director, Mr. Pietro Baracchi, resigned last August, and no successor has been appointed by the government of Victoria, which has decided to abandon the work of this official observatory in order to save the expense of its upkeep, about $20,000 a year.

The Asteroid Aethra forms the subject of a recent note by Mr. Dinsmore Alter. This planet was discovered by Prof. Watson on June 10th, 1873, but has never been seen since twenty-two days after its discovery. Orbits were computed for it by Watson and Luther. Its orbit has been recomputed and the range of solution determined, but as this range is very large it is impossible to find the asteroid by means of a search ephemeris. A suspected observation of the asteroid at the Lowell Observatory in 1913, which can be reconciled with the orbit based on the observations of 1873, furnishes data by means of which it is hoped that Æthra will be rediscovered this year. This asteroid is famous for the eccentricity of its orbit, almost equal to that of a comet.

The Use of the Zodiac in Architectural Decoration is discussed by F. Boquet, of the Observatory of Paris, in a recent memoir on "Art and Astronomy." The signs of the zodiac are a common sculptural motive in Romanesque and Gothic cathedrals. They are found on most French cathedrals of the 12th and 13th centuries. In some cases no attempt has been made to arrange them in their correct sequence. This may have been the result of negligence or ignorance, or may have been due to a deliberate disregard of their symbolical character for the sake of producing an artistic effect. The zodiacal figures are also found in mediæval stained glass and in pavements. One of the most beautiful modern examples of their use is in the celebrated Fontaine de l'Observatoire, in Paris, where the zodiac is shown on an armillary sphere and is given its proper inclination to the celestial equator.

Sunspots and Terrestrial Temperatures.—The relations between sunspots and terrestrial temperatures were somewhat fully worked out by W. Köppen about 40 years ago, with the result that, in general, times of sunspot maximum were found to correspond with periods of deficient temperature, and vice versa, the parallelism being most marked for temperatures within the tropics. This conclusion is confirmed in a recent study by Dr. Gilbert T. Walker, director of the Indian meteorological service. Dr. Walker publishes correlation coefficients for a large number of stations widely distributed over the earth. The defect of temperature at sunspot maximum is found to prevail at a majority of stations, especially in the tropics; but in a large area stretching from the Arctic over western Europe the reverse relation is found to prevail.

Conditions of Life on Venus.—Mr. C. E. Housden, an English hydraulic engineer, published a few years ago a somewhat startling book on Mars, in which he furnished detailed information in regard to the system of pipes and pumping-stations whereby (in his opinion) the Martians are enabled to irrigate their arid planet. He has now produced a little *brochure*, entitled "Is Venus Inhabited?" in which similar engineering achievements are attributed to the problematical inhabitants of Venus. Mr. Housden sets out from the opinion of Schiaparelli and Lowell that Venus always turns the same face to the sun. Admitting the presence of water, this would result in one half of the planet's surface being permanently locked in ice, while on the other excessively hot and arid conditions would prevail. The writer assumes the habitable portion of the planet to be a zone of the sunlit hemisphere bordering the ice fields of the dark hemisphere. Melting glaciers from this ice would supply water, which, to prevent evaporation, the Venusians would convey in pipes rather than open channels to the places where they desired to use it. The book contains an extensive discussion of Venusian meteorology, and is plausible enough to be interesting.

Science

Marquis Raffaele Cappelli has resigned the presidency of the Reale Società Geografica in consequence of comments on his pro-German attitude, and *Nature* raises the question whether he will also relinquish his position at the head of the International Institute of Agriculture, which he has held since 1910.

Saponins, which are widely distributed among plants, possess the property of dissolving the red blood corpuscles. Some of these substances are extensively used in carbonated beverages to produce a heavy foam, and accordingly the Bureau of Chemistry has undertaken an investigation of the effects of their prolonged use by man, in connection with the administration of the Food and Drugs Act.

Ferns as Weeds.—Of the 200 species of ferns native to this country a few have become more or less serious weed pests. The most troublesome are the hay-scented fern and the brake. According to a recent bulletin of the Department of Agriculture, cutting off the tops close to the soil surface twice a year for two years will kill out nearly all ferns. The best times to do the cutting are just previous to sporing, or about the middle of June and the middle of August, in southern New York.

The Vitamines, those substances which are now regarded as so important in the diet as a preventive of diseases of the general nature of scurvy and beriberi, form the subject of investigations recently undertaken by the U. S. Bureau of Chemistry. The literature of the vitamines, though extending back only three years, has already grown to respectable proportions. Thirteen papers on the subject are listed in the latest volume of the Index Catalogue of the Library of the Surgeon-General's Office, and several others have been abstracted in recent volumes of the Experiment Station Record.

The Enormous Value of Rainfall to the agriculturist is set forth by Mr. E. J. Cragoe in the *Journal of Geography*. He calculates that the increase in the wheat crop in the Dakotas, California, Washington, Kansas and Nebraska for each inch of rainfall above four inches in May and June represents a value of about $15,000,000. The figures for maize are more impressive; one inch of rainfall above three inches in July in Indiana, Illinois, Kansas, Iowa, Ohio and Nebraska, increases the value of the crop by $160,000,000. Moreover, it was found that when the July rainfall averaged less than 3.4 inches the yield of maize averaged ten bushels less per acre than when it was more than 4.4 inches. This represents an increased value of about $250,000,000. No wonder grain speculators watch the weather reports with an anxious eye!

The Homing Capacity in Terns has been the subject of interesting experiments by Prof. J. B. Watson and Dr. K. S. Lashley, at Bird Key, Dry Tortugas, under the auspices of the Carnegie Institution. Birds were caught in their nesting places, tagged, marked with paint on head and neck, and carried in large cages to a distance, whereupon they were liberated and watch was kept for their return. It was found that "the noddy and sooty tern can return from distances up to 1,000 miles in the absence of all landmarks, at least so far as the term 'landmark' is understood at present." A return from the open sea was found to be effected as readily as from a place on the coast. Birds returned from Galveston, from Cape Hatteras, from Havana, etc. In these cases, however, a certain percentage did not return. The report on these experiments discusses various proposed explanations of the homing capacity in birds, without reaching any conclusion.

The History of the Tilefish (*Lopholatilus chamæleonticeps*), as retold in a recent circular of the Bureau of Fisheries, is full of romantic interest. This fish was discovered in 1879, when a New England fisherman, Capt. Kirby, caught several thousand pounds of a "strange and handsomely colored fish" not far south of Nantucket, and sent a specimen to the U. S. Fish Commission, which found it to be a new species. The fish proved to have edible qualities of a high order, and to be present in enormous numbers within easy reach of the coast. Hardly, however, had measures been set on foot to establish tile fishing as an industry, when the species was apparently exterminated by a mysterious disturbance along the edge of the slope. In March and April, 1882, dead tilefish covered an area 170 miles long and 25 miles wide, and it was estimated that upwards of 1,400,000,000 had perished. The most plausible explanation of this disaster is that it was due to a displacement of the Gulf Stream. The tilefish is a bottom dweller and also requires a rather high water temperature. Apparently the Gulf Stream, receding from the shore, no longer extended downward to the shelving bottom, and the fish perished in the colder water which replaced it. After ten years, during which none of these fish were taken, the Gulf Stream returned to its old course, and the tilefish reappeared. It is now as abundant as ever, and the Bureau of Fisheries is trying to make its merits known to the public.